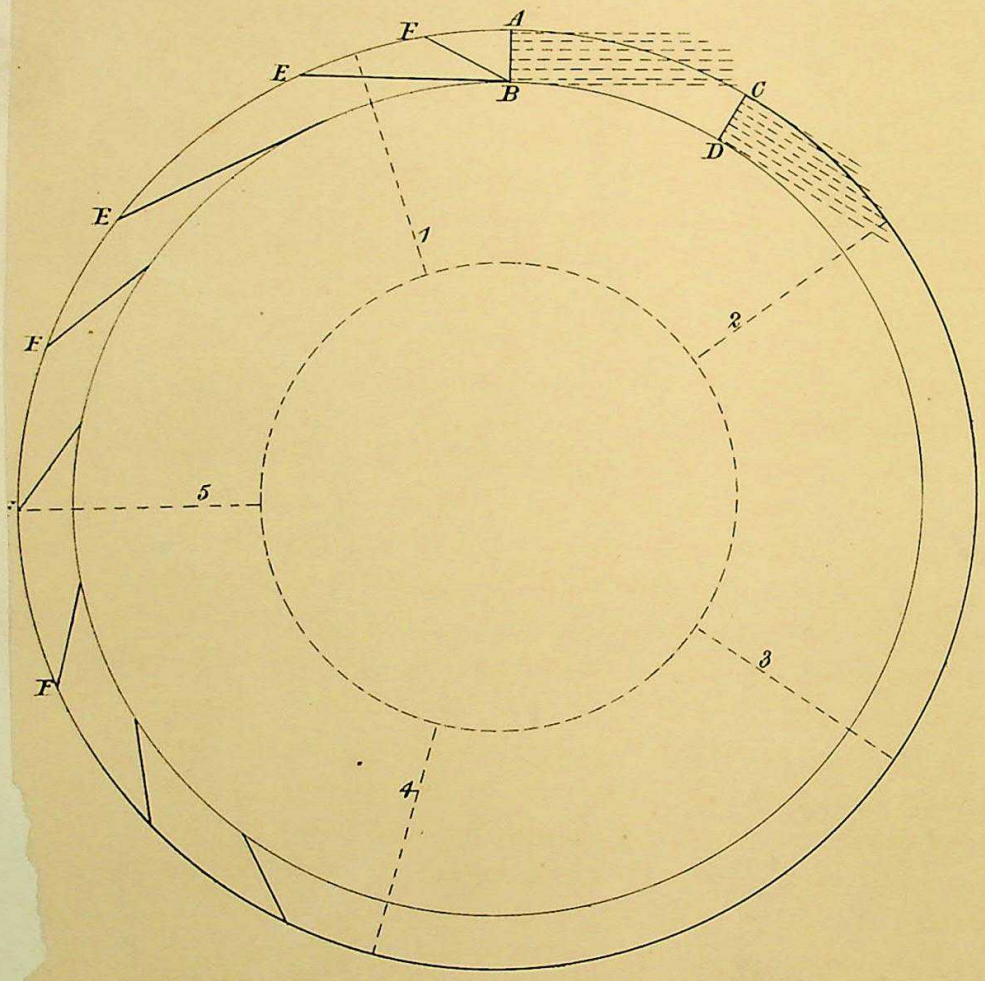
230/134.4 230 R 28 230/134 1,381 416/223

(1 SHEET)

A. D. 1853. JUNE 4. Nº 1381.

BIRAM'S PROVISIONAL SPECIFICATION.

Rotary ~~Fan~~ Blower for Ventilators



VANE LIKE EB OR FB RATHER THAN AB.

The drawing left with Provisional Specification is not coloured.

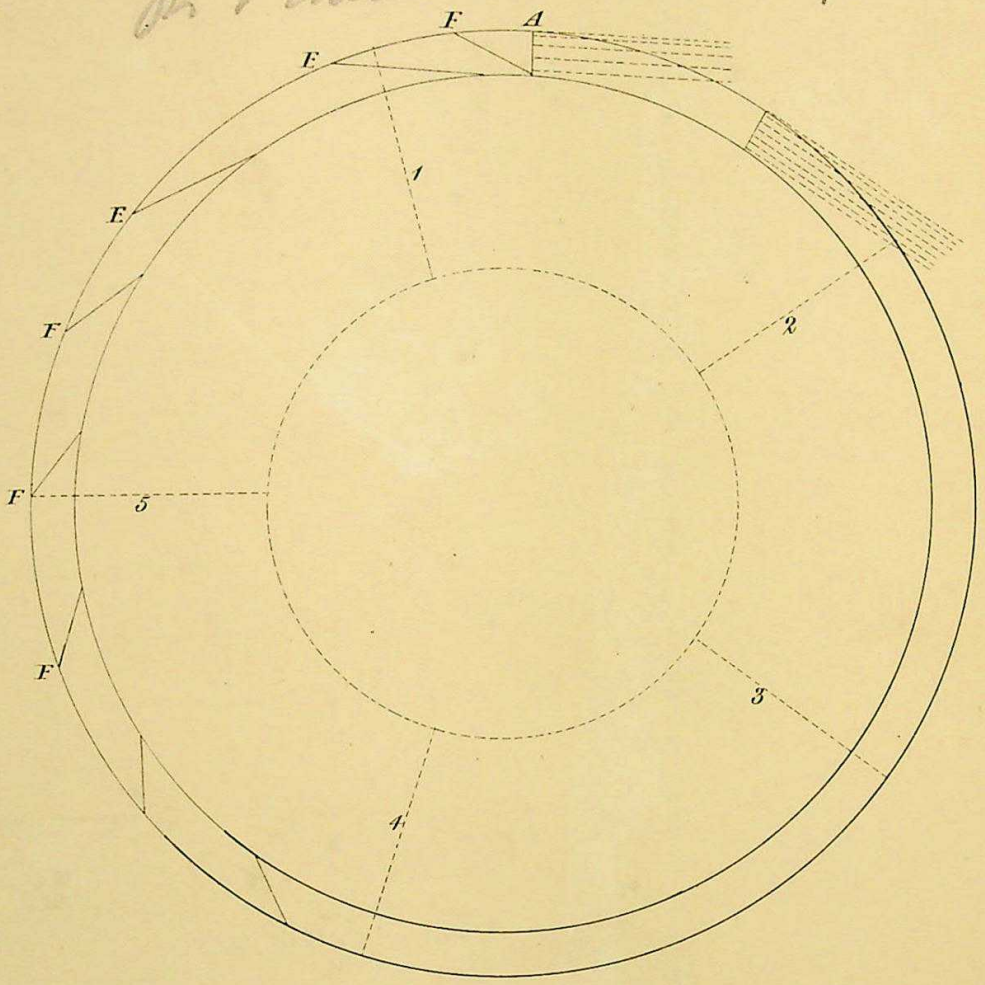
Malby & Sons, Lith.

LONDON: Printed by GEORGE EDWARD EYRE and WILLIAM SPOTTISWOODE.
Printers to the Queen's most Excellent Majesty. 1853.

June 4th 1853
No 1381
Rotary Blower for Ventilation

230
1340 4

FIG. 4.



The filed drawing is not colored.

LONDON: Printed by
Printers to

A.D. 1853 . . . . . N° 1381.

Working and Ventilating Mines.

LETTERS PATENT to Benjamin Biram, of Wentworth, in the County of York, Gentleman, for the Invention of "IMPROVEMENTS IN WORKING AND VENTILATING MINES."

Sealed the 25th November 1853, and dated the 4th June 1853.

PROVISIONAL SPECIFICATION left by the said Benjamin Biram at the Office of the Commissioners of Patents, with his Petition, on the 4th June 1853.

I, BENJAMIN BIRAM, of Wentworth, in the County of York, Gentleman, do hereby declare the nature of the said Invention for "IMPROVEMENTS IN WORKING AND VENTILATING MINES" to be as follows:—

My improvements consist in fixing the drums upon which flat ropes are wound over the pit for drawing up coals or minerals, and applying the power of two engines to cranks fixed at right angles to each other upon the shaft of one of them, the other having also cranks at the end of the shaft similarly fixed, and the two being connected by coupling bars, exactly in the way that four driving wheels are connected in a

locomotive engine. The engines may be fixed either vertically or horizontally to suit circumstances, and coupled and worked by the link motion and reversing gear on the locomotive plan.

The advantage of this arrangement is, beside dispensing with a fly wheel and extra pulley wheels over the pit top, the facility which it gives of enclosing the whole of the machinery within a moderate sized building, and making the communication with the pit mouth by two doors, one only to be open at the same time, and thereby rendering a pit ventilated by a fan or other machinery available both as an upcast and drawing shaft. The engine man has also more control over his engine, and an earlier sight of the corves, by which the risk of raising them too high is diminished.

The ventilator which I employ is driven by a separate engine. It is placed near the head of the shaft, and is of the particular description herein-after given. The application of a fan for the ventilation of mines has now for some years been before the public. Mr. Brunton having described one before the Committee appointed by the House of Lords to enquire into the cause of accidents in mines, and Mr. Nasmyth having also erected one, a full description of which appeared in most of the public papers at the time. Mr. Naysmth's fan has five vanes (1, 2, 3, 4, 5), each about half the depth of the radius, the air being admitted to the fan in the centre, and projected by its rapid revolution beyond the periphery in a tangential direction on all sides. As the efficacy of such a fan must be mainly produced by the outer end of the vanes, it would appear desirable to diminish their depth from one half to one tenth of the radius, and increase their number to so many as that a tangent from the point B, of one vane should just clear the outer end C, of the adjoining vane. The assumed effect of this would be, that when the fan was in operation the volume of air occupying the space A, B, C, D, would be projected beyond the periphery by each vane, whilst the fan rotated from A, to C. But this would be in a tangential direction B, C, as shewn by the dotted lines, and which as the resistance increases as the square of the velocity would be the direction requiring the most power for the least effect. I, therefore, propose to fix vanes as at E, B, instead of B, A, so that

the edge only of the vane would be presented to the wind, yet the same quantity of air would be projected beyond the gyration of the fan in a given time, but in the direction B, A, instead of B, C. Suppose the length A, B, one foot, the distance B, C, would be 4·5 feet, and the resistance to the vane A, B, from the air would be $1 \times 4{\cdot}5^2 = 20{\cdot}25$ per square foot, If B, E, were the vane, the resistance would be $4{\cdot}5 \times 1^2 = 4{\cdot}5$ (B, C, × A, B^2), so that a fan with tangential vanes E, B, might be driven at double the velocity, and past more than double the quantity of air, with the same power as a fan with the radial vanes A, B. I also place the vanes at an intermediate angle between E, B, and A, B, as at F, B.

SPECIFICATION in pursuance of the conditions of the Letters Patent, filed by the said Benjamin Biram in the Great Seal Patent Office, on the 3rd December 1853.

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, Benjamin Biram, of Wentworth, in the County of York, Gentleman, send greeting.

WHEREAS Her most Excellent Majesty Queen Victoria, by Her Letters Patent, bearing date the Fourth day of June, in the year of our Lord One thousand eight hundred and fifty-three, in the sixteenth year of Her reign, did, for Herself, Her heirs and successors, give and grant unto me, the said Benjamin Biram, Her special licence that I, the said Benjamin Biram, my executors, administrators, and assigns, or such others as I, the said Benjamin Biram, my executors, administrators, and assigns, should at any time agree with, and no others, from time to time and at all times thereafter during the term therein expressed, should and lawfully might make, use, exercise, and vend, within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an Invention for "**Improvements in Working and Ventilating Mines,**" upon the condition (amongst others) that I, the said Benjamin Biram, by an instrument in writing under my hand and seal, should particularly describe and ascertain the nature of the said Invention, and in what manner the same was to be performed,

and cause the same to be filed in the Great Seal Patent Office within six calendar months next and immediately after the date of the said Letters Patent.

NOW KNOW YE, that I, the said Benjamin Biram, do hereby declare the nature of my said Invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement thereof, reference being had to the Drawings hereunto annexed, that is to say:

Firstly. My improvements consist in fixing the drums upon which flat ropes are wound over the pit for drawing up coals or minerals, and applying the power of two engines to cranks fixed at right angles to each other upon the shaft of one of them, the other having also cranks at the end of the shaft similarly fixed, and the two being connected by coupling bars exactly in the way that four driving wheels are connected in a locomotive engine. The engines may be fixed either vertically or horizontally to suit circumstances, and coupled and worked by the link motion and reversing gear on the locomotive plan.

The advantage of this arrangement is, besides dispensing with a fly wheel and extra pulley wheels over the pit top, the facility which it gives of enclosing the whole of the machinery within a moderate sized building, and makng the communication with the pit's mouth by two doors, one only to be open at the same time, and thereby rendering a pit ventilated by a fan or other machinery available both as an upcast and drawing shaft. The engine man has also more control over his engine, and an earlier sight of the corves by which the risk of raising them too high is diminished; for the momentum of the fly wheel being removed, the corves may be instantly stopped upon arriving at the pit's mouth, and the distance between the pit's mouth and the pulley wheels may safely be diminished.

Figure 1, of the Drawings hereunto annexed is a side elevation of a pair of engines, with their lifting drums arranged on my plan over the pit's mouth, shewing also a part of the pit in section. Figure 2, is an end elevation of the same, shewing also a section of part of the pit taken at right angles to Figure 1; and Figure 3, is a plan of the engines and drums. A, A^1, are the drums, which are fixed on shafts A^2, A^2,

which are mounted and revolve in the bearings A^3, A^3, attached to the framing A^4, A^4, over the pit's mouth. B, B, are the cylinders of the pair of engines, and B^1, B^1, their piston rods, which are respectively connected by the connecting rods B^2, B^2, to the cranks C, C, fixed at right angles to each other upon the shaft of the drum A. B^3 B^3, are links, and B^4, B^4, radius rods forming a parallel motion, by which the piston rods of the cylinders B, B, are respectively preserved in a perpendicular position during their upward and downward motions. The other drum A^1, has also cranks D, D, at the ends of its shaft fixed at right angles to each other, as before described with reference to the cranks C, C; and the two sets of cranks C, C, and D, D, are coupled together by connecting rods E, E, so that the drums A, A^1, revolve together in the same direction, so that the rope upon one drum descends while the other ascends. F, F, are excentrics for working the slide valves G, G, of the cylinders B, B, to which they are connected by the excentric rods H, H. The ends of each pair of excentric rods H, H, are jointed to the ends of a slotted link I, Figure 1. One only of these is seen in the Drawings, but both engines are fitted in the same manner. K, is a stud on the slide valve spindle, which takes into the slot of the link I. L, is a link by which the slotted link I, is connected to the end of the bell crank lever M, the short arm of which is again connected by a rod N, to a reversing lever O, centred at P, by means of which arrangements the engines are started, reversed, and stopped when required. The parts just described are similar to the arrangements adopted in locomotive engines, and may be considerably varied should circumstances require it.

Secondly. My improvements relate to the ventilation of mines. The ventilator which I employ is driven by a separate engine; it is placed near the head of the shaft, and is a fan of the particular description herein-after given. The application of a fan for the ventilation of mines has now for some years been before the public. Mr. Brunton having described one before the Committee appointed by the House of Lords to enquire into the causes of accidents in mines, and Mr. Nasmyth having also erected one, a full description of which appeared in most of the public papers at the time. Mr. Nasmyth's fan has five vanes,

1, 2, 3, 4, 5, (see Figure 4,) each about half the depth of the radius, the air being admitted to the fan in the centre, and projected by its rapid revolution beyond the periphery in a tangential direction on all sides. As the efficiency of such a fan must be mainly produced by the outer end of the vanes, it would appear desirable to diminish their depth from one half to one tenth of the radius, and to increase their number to so many, as that a tangent from the point B, of one vane should just clear the outer end C, of the adjoining vane. The assumed effect of this would be, that when the fan was in operation the volume of air occupying the space A, B, C, D, would be projected beyond the periphery by each vane, whilst the fan rotated from A, to C. But this would be in a tangential direction B, C, as shewn by the dotted lines, and which as the resistance increases as the square of the velocity would be the direction requiring the most power for the least effect. If the vanes, however, were fixed as at E, B, instead of B, A, so that the edge only of the vane would be presented to the wind, it is presumed the same quantity of air would be projected beyond the gyration of the fan in a given time, but in the direction B, A, instead of B, C. Suppose the length A, B, one foot, the distance B, C, would be 4·5 feet, and the resistance to the vane A, B, from the air would be $1 \times 4{\cdot}5^2 =$ 20·25 per square foot. But if B, E, were the vane, the resistance would be $4{\cdot}5 \times 1^2 = 4{\cdot}5$ (B, C, × A, B^2), so that a fan with tangential vanes E, B, might be driven at double the velocity, and pass more than double the quantity of air with the same power as a fan with the radial vanes A, B. I propose, therefore, to employ for the ventilation of mines fans having blades placed tangentially as at E, B, or at an intermediate angle between E, B, and A, B, as at F, B. Figures 1, and 3, shew the position with respect to the pit and lifting engines in which I place my ventilators. The fan is closed in at top, and the spindle is furnished with a crank, by which it may be driven from a separate small engine placed in any convenient position for that purpose.

And having now described the nature of my said Invention, and in what manner the same is to be performed, I declare that what I claim as my Invention is,—

First, the mode of working mines by means of coupled lifting engines and drums, arranged and working in the manner herein-before described.

Second, the adaptation of a link motion for starting, stopping, or reversing coupled engines employed in working mines, as herein-before described ; and,

Third, the employment for ventilating mines of a fan with blades placed tangentially, or at an angle between a radial and tangential direction, as represented in the Drawings, and herein-before described.

In witness whereof, I, the said Benjamin Biram, have hereunto set my hand and seal, this Twenty-third day of November, One thousand eight hundred and fifty-three.

BEN. BIRAM. (L.S.)

LONDON :
Printed by GEORGE EDWARD EYRE and WILLIAM SPOTTISWOODE,
Printers to the Queen's most Excellent Majesty. 1853.